

- 1 -

FLUID-TIGHT SLIDE FASTENER

The present invention relates to fluid-tight (airtight and watertight) slide fasteners, and more particularly to a fluid-tight slide fastener suitable for working clothes for construction workers in rivers, fishermen and farmers.

Known airtight and watertight (hereinafter referred to as "fluid-tight") slide fasteners have a fluid-tightness throughout the entire length thereof including at portions around top stops. As disclosed in Japanese Patent Publication (Kokoku) 34-10974 and as reillustrated here in FIGS. 10A, 10B and 10C, this prior slide fastener has a top stop B of generally C-shaped cross section, secured in clinched form to top end portions A of a pair of opposed fastener stringers so as to effect a fluid-tightness therebetween; the upward movement of a slider C is terminated when the slider C comes into abutting engagement with a lower end of the top stop B. In other words, the top stop B does not enter the guide

channel of the slider C even when the slide fastener is fully closed.

Because of such exposed top stop B, the prior slide fastener is unpleasant in appearance. In addition, the portions around the top stop tend not to be fluid-tight. Nonetheless, it is believed that there has heretofore been proposed no fluid-tight slide fastener in which portions around the top stop are left to be not fluid-tight.

According to the present invention, there is provided a fluid-tight slide fastener comprising: a pair of fastener stringers each including a fluid-tight tape, a series of discrete coupling elements mounted on said tape along an inner longitudinal edge portion thereof, each of said coupling element having a base portion, a leg portion and a head portion, said inner longitudinal edge portion of said tape being folded so as to extend around said base portion of each said coupling element, a series of generally U-shaped first clamping strips each surrounding said folded edge portion of said tape over said base portion of a respective one of said coupling elements, and a pair of top stops each mounted on the respective tape at a position adjacent to a top end of said series of coupling elements; a slider mounted on said pair of fastener stringers for movement along such two series of coupling elements to open and close the slide

fastener, said slider having a generally Y-shaped guide channel for the passage of said two series of coupling elements; and each said top stop including an elongate plate of a generally I-shaped cross section substantially corresponding to the cross section of the individual coupling element, said elongate plate having such a length as to be completely received in said guide channel of said slider when the slide fastener is fully closed, said folded edge portion extending around a base part of said elongate plate which part corresponds to said base portion of the individual coupling element, and an elongate second clamping strip of a generally U-shaped cross section substantially corresponding to the cross section of the individual clamping strip, said second clamping strip surrounding said folded edge portion of said tape over said base part of said elongate plate.

It is believed possible by means of the present invention to provide a fluid-tight slide fastener having a pair of top stops which can entirely enter a coupling-element guide channel of a slider when the slide fastener is fully closed, thus making the slide fastener neat in appearance.

It is further believed possible by means of the present invention to provide a fluid-tight slide fastener having a pair of top stops which can stop a

slider reliably.

The invention will be described by way of example with reference to the accompanying drawings, in which like references refer to like parts unless
5 stated otherwise, and in which:-

Figure 1 is a fragmentary perspective view of a fluid-tight slide fastener embodying invention;

Figure 2 is a fragmentary transverse cross-sectional view of the Figure 1, showing the state
10 in which a pair of series of coupling elements is coupled together;

Figure 3 is a fragmentary transverse cross-sectional view of Figure 1, showing the manner in
15 which one of opposed top stops is attached to a respective tape;

Figure 4 is a plan view, with parts in cross section, of Figure 1, showing top end portions of opposed fastener stringers in uncoupled position;

20 Figure 5 is a view similar to Figure 4, showing the top stops having entirely entered a slider to prevent further upward movement of the slider;

Figure 6A is a fragmentary plan view of a first blank strip, illustrating the manner in which the
25 coupling elements and the top stops are manufactured from the first blank strip;

Figure 6B is a transverse cross-sectional view of Figure 6A;

Figure 6C is a plan view of the individual coupling element;

5 Figure 6D is a plan view of the individual top stop;

Figure 7A is a fragmentary plan view of a second blank strip, illustrating the manner in which first and second clamping strips are manufactured from the second
10 blank strip;

Figure 7B is a transverse cross-sectional view of Figure 7A;

Figure 7C is a plan view of the individual first clamping strip;

15 Figure 7D is a plan view of the individual second clamping strip;

Figures 8 and 9 are fragmentary perspective views respectively showing modified second clamping strips;

20 Figure 10A is a fragmentary plan view, with parts in cross section, of a prior art fluid-tight slide fastener;

Figure 10B is a side elevational view of Figure 10A; and

25 Figure 10C is a transverse cross-sectional view taken along line 10C - 10C of Figure 10B.

Figure 1 shows a fluid-tight slide fastener

comprising a pair of opposed fastener stringers, each including a tape 5 made of a fluid-tight soft material such as natural or synthetic rubber, or made of natural or synthetic fibers coated with such a fluid-tight material. As shown in Figures 1, 2 and 3, the tape 5 has an inner longitudinal margin folded through its entire length so as to provide a folded edge portion 3 and two contact portions (hereinafter referred to as "first and second contact portions 5a, 5b disposed one on each side of the edge portion 3 and contiguous thereto. The first and second contact portions 5a, 5b are laterally (vertically in Figures 1, 2 and 3) spaced from each other. The first and second contact portions 5a, 5b of one stringer are adapted to engage corresponding first and second contact portions 5a, 5b of the other stringer to effect a fluid-tightness i.e. air tightness and watertightness, between the two stringers.

A series of discrete coupling elements 1 is mounted on and along the folded edge portion 3 of each tape 5; each coupling element 1 has a generally I-shaped cross section having a base portion 2a, a leg portion 2b, and a head portion 2. The folded edge portion 3 of the tape 5 extends around the base portion 2a of each coupling element 1. A series of generally C-shaped first clamping strips 4 is also mounted in clinched form on and along the folded edge portion 3 of the tape 5, each first clamping strip 4 surrounding the

folded edge portion 3 of the tape 5 over the base portion 2a of a respective one of the coupling elements 1. The series of coupling elements 1 of one stringer is engageable with the series of coupling elements 1 of the other stringer by pulling a slider 10 which is mounted on the opposed stringers for movement along such two series of coupling elements 1 to open and close the slide fastener.

The slider 10 defines a guide channel 12 for the passage of the two series of coupling elements 1, 1, and has a central separator 11 (Figures 1, 4 and 5) dividing a flaring end of the guide channel 12 into two branches. The central separator 11 has in its opposite side surfaces a pair of grooves 13, 13 each opening to a respective one of the branches of the guide channel 12 for receiving the head portions 2 of the respective series of coupling elements 1. When the slider 10 is pulled upwardly or forwardly along the opposed series of coupling elements 1, 1 to couple the same together, the first and second contact portions 5a, 5b of one stringer are pressed against the first and second contact portions 5a, 5b of the other stringer as shown in Figure 2 to effect a fluid-tightness between the two stringers.

The slide fastener also has a pair of top stops 9, 9 each attached to a respective one of the stringers at a position adjacent to a top end of each series of

coupling elements 1 for restricting the upward movement of the slider 10 in a manner described below. Most importantly, each top stop 9 includes an elongate plate 6 mounted on the folded edge portion 3 of the tape 5 and having a generally I-shaped cross section substantially corresponding to the cross section of the individual coupling element 1. The elongate plate 6 has a base part 7a, a leg part 7b and a head part 7, which correspond to the base portion 2a, the leg portion 2b and the head portion 2, respectively, of the individual coupling element 1. The folded edge portion 3 of the tape 5 extends around the base portion 7a. Each top stop 9 also includes a second clamping strip 8 mounted in clinched form on the folded edge portion 3 of the tape 5 and having a generally C-shaped cross section corresponding to the cross section of the individual first clamping strip 4. The second clamping strip 8 surrounds the folded edge portion 3 of the tape 5 over the base part 7a of the elongate plate 6. The elongate plate 6 has such a length as to be completely received in the guide channel 12 of the slider 10 as shown in Figure 5 when the slide fastener is fully closed.

When the slider 10 is pulled upwardly in Figure 4, the opposed series of coupling elements 1, 1 are coupled with each other progressively toward the top stops 6, 6 so as to effect an adequate fluid-tightness between the opposed stringers through the entire length

of the opposed series of coupling elements 1, 1. With continued upward pulling of the slider 10, the two elongate plates 6, 6, together with the respective second clamping strips 8, 8, enter the two branches of the guide channel 12 of the slider 10 until the two elongate plates 6, 6 block each other at the junction of the two channel branches, thus preventing further upward movement of the slider 5 reliably. The two grooves 13, 13 of the central separator 11 serve to receive the respective head parts 7, 7 of the two elongate plates 6, 6, so that the two elongate plates 6, 6 can enter the guide channel 12 smoothly in proper posture.

The individual coupling elements 1 and the individual elongate plate 6 are manufactured from a continuous length of first blank strip 15 of generally I-shaped cross section (Figure 6B) by punching and/or cutting the first blank strip 15. Preferably, the length of each elongate strip 5 is several times the width of a single coupling element 1.

Likewise, the individual first clamping strip 4 and the individual second clamping strip 8 are manufactured from a continuous length of second blank strip 16 by punching and cutting the second blank strip 16. Preferably, the length of each second clamping strip 8 is several times the width of a single first clamping strip 4. In the embodiment of Figures 1 and

7D, each second clamping strip 8 is in the form of three first clamping strips 4 spaced laterally at regular distances and integrally connected to one another by connecting portions 17.

5 As shown in Figures 7A and 7D, each of the first and second clamping strips 4, 8 has in its inside surface a plurality of laterally spaced grooves 18 which serve to prevent the clamping strips 4, 8 from being displaced longitudinally along the folded edge
10 portion 3 of the tape 5. Alternatively, these grooves 18 may be replaced with ridges for the same result.

 Figures 8 and 9 show modified second clamping strips 8a, 8b, respectively. The second clamping strip 8a of Figure 8 is composed of three separate pieces
15 each in the shape of a single first clamping strip 4 of Figures 1, 2 and 7C. The second clamping strip 8b of Figure 9 is a single piece having a uniform cross section through its entire length.

 The first and second blank strips 15, 16 of
20 Figures 6A, 6B, 7A and 7B are made of metal. Alternatively, the first blank strip 14 may be made of hard synthetic resin. In another alternative form, the elongate plates 6 are individually formed by injection-molding synthetic resin material.

25 Because each top stop comprises an elongate plate having a cross section substantially

corresponding to the cross section of the individual coupling element and a second clamping strip having a cross section substantially corresponding to the cross section of the individual first clamping strip, the opposed top stops
5 can enter the guide channel of the slider smoothly when the slider is pulled upwardly or forwardly to close the slide fastener. At that time the upward movement of the slider is not prevented until the opposed top stops are entirely inserted into the guide channel of the
10 slider to abut against each other, without any part thereof exposed to the outside, thus making the slide fastener neat in appearance.

Further, partly because the base part of each elongate plate is surrounded by the folded edge portion
15 of the respective tape, and partly because each second clamping strip surrounds, in clinched form, this folded edge portion over the base part of the elongate plate, firm attachment of the top stops to the fastener stringers can be achieved.

20 In addition, since the opposed elongate plates block each other accurately at the junction of the two branches of the guide channel in the slider as the slider fastener is fully closed, it is possible to stop the upward movement of the slider reliably.



CLAIMS:-

1. A fluid-tight slide fastener comprising:

(a) a pair of fastener stringers each including

1) a fluid-tight tape,

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2) a series of discrete coupling elements mounted on said tape along an inner longitudinal edge portion thereof, each of said coupling element having a base portion, a leg portion and a head portion,

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3) said inner longitudinal edge portion of said tape being folded so as to extend around said base portion of each said coupling element,

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4) a series of generally U-shaped first clamping strips each surrounding said folded edge portion of said tape over said base portion of a respective one of said coupling elements, and

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5) a pair of top stops each mounted on the respective tape at a position adjacent to a top end of said series of coupling elements;

(b) a slider mounted on said pair of fastener stringers for movement along such two series of coupling elements to open and close the slide fastener, said slider having a generally Y-shaped guide channel for the passage of said two series of coupling elements; and

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wherein each said top stop includes

1) an elongate plate of a generally I-shaped cross section substantially corresponding to the cross section of the individual coupling element, said elongate plate having such a length as to be completely received in said guide channel of said slider when the slide fastener is fully closed, said folded edge portion extending around a base part of said elongate plate which part corresponds to said base portion of the individual coupling element, and

2) an elongate second clamping strip of a generally U-shaped cross section substantially corresponding to the cross section of the individual first clamping strip, said second clamping strip surrounding said folded edge portion of said tape over said base part of said elongate plate.

2. A fluid-tight slide fastener according to claim 1, said length of said elongate plate being several times the width of each individual coupling element.

3. A fluid-tight slide fastener according to claim 2, said length of said second clamping strip being several times the width of the individual first clamping strip.



4. A fluid-tight slide fastener according to claim 2, said second clamping strip being in the form of several first clamping strips spaced laterally at regular distances and integrally connected to one another by connecting portions.

5 5. A fluid-tight slide fastener according to claim 2, wherein said second clamping strip comprises at least two first clamping strips spaced laterally at regular distances.

6. A fluid-tight slide fastener according to any preceding claim, each of said first and second clamping strips having in its inside
10 surface a plurality of laterally spaced grooves.
